

PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project Inventory Resident Fish Populations in the Bonneville, The Dalles, and John Day Reservoirs.	
BPA project number	20066
Contract renewal date (mm/yyyy)	
Multiple actions? (indicate Yes or No)	
Business name of agency, institution or organization requesting funding United States Geological Survey, Biological Resources Division	
Business acronym (if appropriate)	USGS, BRD
Proposal contact person or principal investigator:	
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NPPC Program Measure Number(s) which this project addresses Section 10.2, Section 2.1A.1, Section 2.2A, Section 7.1, Section 5.7A.3, Section 5.7B.12, Section 5.7B.14, Section 5.7B.15.	
FWS/NMFS Biological Opinion Number(s) which this project addresses	
Other planning document references Development of a Regional Framework for Fish and Wildlife Restoration in the Columbia River Basin, A Proposed Scientific Foundation for the Restoration of Fish and Wildlife in the Columbia River Basin NWPPC 98-16; Review of the Columbia River Basin Fish and Wildlife Program for Fiscal Year 1999 as Directed by the 1996 Amendment to the Northwest Power Act ISRP 98-1; Report of the Independent Scientific Review Panel, Review of the Columbia River Basin Fish and Wildlife Program as directed by the 1996 amendment to the Power Act, III.B.13; Proposed Recovery Plan for Snake River Salmon, 2.8.b.2, National Marine Fisheries Service, 1995.	
Short description Provide baseline information on the relative abundance and community structure of resident fish species in the three lowermost impoundments on the Columbia River by reservoir and habitat type.	
Target species	

All resident fish species in the Bonneville, The Dalles, and John Day reservoirs.

Section 2. Sorting and evaluation

Subbasin

Mainstem Columbia River

Evaluation Process Sort

CBFWA caucus		CBFWA eval. process		ISRP project type	
X one or more caucus		If your project fits either of these processes, X one or both		X one or more categories	
	Anadromous fish		Multi-year (milestone-based evaluation)		Watershed councils/model watersheds
X	Resident Fish		Watershed project eval.		Information dissemination
	Wildlife				Operation & maintenance
					New construction
				X	Research & monitoring
					Implementation & mgmt
					Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description
20515	Mainstem Columbia River Umbrella Project

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?

Objectives and tasks

Obj 1,2, 3	Objective	Task a,b,c	Task
1	Develop strict sampling protocols, standardized sampling gears, and procedures for implementing a stratified random sampling design to be used in resident fish surveys.	a	Assess the efficacy of various sampling gears to characterize resident fish populations. (FY 2000-2001)
		b	Develop sampling protocols for collecting and recording survey data. (FY 2000-2001)
		c	Develop procedures for implementing a stratified random sampling design to be used in the surveys. (FY 2000-2001)
2	Assess the status of resident fish populations in the Bonneville, The Dalles, and John Day reservoirs, Columbia River.	a	Implement sampling design and evaluate the sensitivity of sampling intensity to assess the status of resident fish populations (FY 2001-2003)
		b	Analyze and summarize data in a final report and peer-reviewed journal articles. (FY 2003)

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	10/2000	12/2001			100
2	02/2001	10/2003			0
				Total	100

Schedule constraints

Sampling permits will be required.

Completion date

Section 5. Budget

FY99 project budget (BPA obligated):	\$0
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FY2000 budget by line item

Item	Note	% of total	FY2000 (\$)
Personnel	USGS, ODFW, and WDFW	44.7	\$119,474
Fringe benefits		13.0	\$34,799
Supplies, materials, non-expendable property	Sampling gears and miscellaneous field and office supplies.	7.5	\$20,025
Operations & maintenance	Boat operation.	3.2	\$8,640
Capital acquisitions or improvements (e.g. land, buildings, major equip.)			
NEPA costs			
Construction-related support			
PIT tags	# of tags:		
Travel	Per diem and vehicle costs.	4.3	\$11,520
Indirect costs		27.3	\$72,882
Subcontractor			
Other			
TOTAL BPA REQUESTED BUDGET			\$267,340

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount (\$)
USGS	GIS computer support, field equipment.	3.74	\$10,000
ODFW	Personnel, field equipment, computer support.	0.75	\$2,000
WDFW	Personnel, field equipment, computer support.	0.75	\$2,000
Total project cost (including BPA portion)			\$281,340

Outyear costs

	FY2001	FY02	FY03	FY04
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Total budget	\$410,559	\$423,047	\$111,169	
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Section 6. References

Watershed?	Reference
	Angermeir, P. L., and J. R. Karr. 1986. Applying an index of biotic integrity based on stream fish communities: considerations in sampling and interpretation. <i>North American Journal of Fisheries Management</i> 6:418-429.
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PART II - NARRATIVE

Section 7. Abstract

The Independent Scientific Review Panel (ISRP) recently recommended that the Northwest Power Planning Council (NWPPC) require a systematic basin-wide inventory of resident fishes, stating that Section 10.2 of the Fish and Wildlife Program describes the need for such a survey. Further, during their review of FY1999 proposals, the ISRP recommended that this study receive funding, citing its relevance to National Marine Fisheries Service and NWPPC programs. The goal of this proposed study is to assess the status of resident fish populations in the Bonneville, The Dalles, and John Day reservoirs. Study objectives are to: (1) develop standardized sampling gears, protocols, and a statistically valid sampling design that will facilitate designing future resident fish surveys (duration 2000-2001), and (2) assess the status of resident fish populations in the lowest three impoundments on the Columbia River. Sampling gears will be chosen, fished in appropriate habitats, and experimentally evaluated on one reservoir. Objective 2 involves the implementation and evaluation of the surveys (duration 2001-2003). A stratified random sampling design will be implemented by stratifying the reservoirs by enduring geomorphic features representing important fish habitat types. Collection sites will be randomly selected using a geographic information system. The proposed cooperative project between the U. S. Geological Survey, Oregon Department of Fish and Wildlife, and Washington Department of Fish and Wildlife would lay the groundwork for assessing resident fish populations in the Columbia River. These data could be used in evaluations of both local (e.g., hydroelectric operations) and regional projects (e.g., watershed activities that influence mainstem river conditions).

Section 8. Project description

a. Technical and/or scientific background

In a recent review of the Northwest Power Planning Council's Fish and Wildlife Program, the Independent Scientific Review Panel (ISRP) noted that measures in Section 10 imply a logical sequence beginning with an evaluation of the status of resident fish populations (ISRP 1997, p. 29). The ISRP specifically recommend that the Northwest Power Planning Council require a systematic basin-wide inventory of remaining native resident fish populations so that restoration

opportunities can be identified and prioritized. The study we propose will develop standardized gears and methodologies for surveys of resident fishes in the Columbia River Basin and provide baseline information on the status of resident fish populations in the Bonneville, The Dalles, and John Day reservoirs. The data from the proposed study will also provide a basis for determining the effects of mitigative actions, whether specifically designed to aid anadromous or resident fishes, on the native resident fish assemblages in reservoirs of the lower Columbia River.

Determining the relative abundance of resident fishes in the Columbia River Basin is the first step toward identifying and prioritizing the restoration activities recommended in section 10 of the Fish and Wildlife Program. Fish communities in the Columbia River Basin have been affected by a combination of species introductions and extensive habitat degradation following hydroelectric development in the basin (Li et al. 1987; ISG 1996). The construction and operation of hydroelectric dams in the basin have resulted in a loss of highly productive riverine habitat, altered temperature and discharge patterns (Quinn and Adams 1996), continual export of very fine organic matter and dissolved nutrients, simplification of the channel, and loss of floodplain inundation (ISG 1996). These and other anthropogenic disturbances have allowed non-native fishes, such as American shad *Alosa sapidissima*, smallmouth bass *Micropterus dolomieu*, and walleye *Stizostedion vitreum* to establish robust populations (Beamesderfer and Rieman 1991) and resulted in a loss of native biodiversity and biotic integrity (Li et al. 1987, ISG 1996).

If a systematic basin-wide survey of resident fishes is to be conducted in the Columbia River Basin, developing standardized gears and methodologies will facilitate efficient data collection and allow spatial and temporal comparisons between surveys. Information regarding the efficiency and selectivity of sampling gears in capturing most native resident fish species found in the Columbia River Basin is lacking. When surveys are conducted to characterize fish communities, the best method to assess the relative abundance of each fish species is the one that samples the largest number of specimens and captures species in proportion to their abundance in the sampled area (Guetreuter et al. 1995). Since no single method routinely satisfies both criteria due to gear-related and location-related biases, efficiently and accurately assessing the relative abundance of resident fish will involve the selection and evaluation of several gears prior to conducting the surveys (Guetreuter et al. 1995, Hayes et al. 1996, Hubert 1996, Willis and Murphy 1996). Further, the use of standardized sampling devices and development of strict sampling protocols will reduce the variation between samples and increase our ability to detect changes in relative abundance (Fisheries Techniques Standardization Committee 1992).

The value of sampling data is largely determined by the quality or appropriateness of the sampling plan (Brown and Austin 1996). The formation of a statistically valid sampling design increases the utility of surveys of resident fishes by increasing sampling efficiency, allowing comparisons to future surveys by minimizing data biases, and ensuring key statistical assumptions are met (Green 1979). A sampling design based on stratified random sampling will allow unbiased design-based estimates of relative abundance and other statistics (Cochran 1977), and will support other model-based hypothesis tests. Also, stratification can reduce the overall variance of relative abundance estimates and increase the precision of estimated population characteristics. By ensuring the validity of key statistical assumptions, sample sizes can be estimated for detecting significant differences in certain variables and for detecting trends in population characteristics (Guetreuter 1992).

Unfortunately, using data previously collected in the Columbia River to establish baseline information on the status of resident fish populations would be of limited utility. If historical data were used to develop baseline information, valid comparisons would require duplicating the methodologies of studies from which the information was compiled. Since historical data would be compiled from disparate studies, using disparate sampling gears, deployed during disparate times of the year and fished in locations specifically chosen to capture the species of interest, duplicating the methodologies of these studies would be virtually impossible and extremely inefficient. Conversely, we feel that the methodologies we propose will alleviate most of these logistic and analytic difficulties through the standardization of gears and methodologies.

Information is lacking on the biodiversity of resident fish communities and genetic diversity of native resident fish species in the mainstem Columbia River. The Fish and Wildlife Program recognizes the need to ensure that biodiversity is maintained within the basin to protect the integrity and sustainability of ecosystems (section 7.1) and to conserve the genetic diversity of resident native fish (section 10.2B). Approximately 60% of the native fish fauna in the basin are resident in the Columbia and Snake rivers (Li et al. 1987). However, the status of the native fish fauna (particularly non-salmonid species) and consequently the structure and genetic diversity of resident fish communities, remains largely unknown. Notable exceptions to this are the northern pikeminnow *Ptychocheilus oregonensis* that are major predators on juvenile salmonids and support a large fishery (Rieman et al. 1991, Beamesderfer et al. 1996), and white sturgeon *Acipenser transmontanus* that support important commercial, tribal, and recreational fisheries (Miller et al. 1995, Beamesderfer et al. 1995). This proposed study will provide a starting point for understanding the biodiversity of resident fish communities and eventually the genetic diversity of native resident fish.

In addition to providing baseline information on the relative abundance of resident fishes in the Bonneville, The Dalles, and John Day reservoirs, the proposed study will provide information for prioritizing degradations and improvements in the biotic integrity of these areas. While assessing the biotic integrity of the areas to be surveyed is not a specific objective of the proposed study, the nature of the data would inherently lend itself to such an evaluation. The Fish and Wildlife program recognizes the need to explore methods to assess trends in system health (section 2.1A.1). Resident fish communities are routinely sampled in other regions to monitor changes in ecosystem quality over time and to assess responses of fish communities to management and other human activities (Fausch et al. 1984, Angermeir and Karr 1986, Hughes and Gammon 1987, Fausch et al. 1990, Lyons et al. 1996). The most commonly used approach to this type of monitoring involves the use of indices collectively known as the index of biotic integrity (Fausch et al. 1990).

The index of biotic integrity (IBI) proposed by Karr (1981) is a multi-metric index that rates the existing structure, composition, and functional organization of fish assemblages based on expectations from comparable high-quality ecosystems. The lack of sufficiently quantitative historical surveys of the native resident fauna in the lower Columbia River may require that expectations of “excellent” fish assemblages be based on those found in less perturbed areas, such as the Hanford Reach of the Columbia River (Gray and Dauble 1977, Hughes and Gammon 1987, Li et al. 1987). However, fish assemblage reference conditions may also be based on pre-

Columbian stream habitats, ichthyofaunal conditions, and regional fish species pools (Hughes 1995). In a review of the statistical properties of the IBI, Fore et al. (1994) concluded that the IBI was an effective monitoring tool that can be used to convey quantitative assessments in a legal or regulatory context based on confidence intervals or hypothesis testing procedures. Similarly, Hughes et al. (1998) conducted a power analysis and found that the IBI detected an 8% change in mean IBI scores in 1 year and a 2% per year trend in 5 years. This index has been modified and used successfully in many different types of lotic systems throughout North America and more recently in Europe and Asia (Fausch et al. 1984, 1990; Miller et al. 1988; Lyons et al. 1996; Simon and Lyons 1995). The data from this study will contain sufficient information so that commonly used IBI metrics can be estimated.

b. Rationale and significance to Regional Programs

An inventory of resident fish in the mainstem rivers is critical to understanding and evaluating the effects of watershed changes, exotic species invasions, and the manipulations of conditions intended to increase the survival of anadromous fishes. Studies in other river systems have shown how restoration efforts in watersheds may influence water quality and fish communities further downstream, and vice versa (Stanford and Ward 1992). Exotic species, such as American shad, smallmouth bass, and walleye have invaded the Columbia and Snake rivers, possibly displacing resident species and disturbing community relationships. Impoundment of the Columbia River during the last 60 years has produced changes in the seasonal hydrograph and changes in primary and secondary production (Ebel et al. 1989, ISG 1996), that in turn have changed the physical and biotic environment for native fish species in the river. Ongoing actions in the mainstem rivers, such as seasonal spill, channel dredging, and shoreline development, continue to alter the habitats and populations of resident species.

The Northwest Power Planning Council's (NWPPC) Fish & Wildlife Program (Section 10.2) implicitly describes the need for a basin-wide inventory of native resident fish populations and their status. The Report of the Independent Scientific Review Panel (ISRP 1997) specifically recommended that the "*Council require a basin-wide systematic inventory of remaining native resident fish populations and their status, upon which opportunities for restoration and rebuilding native resident fish populations can be identified and prioritized*" (Recommendation III.B.13). Also, during their review of FY1999 proposals (ISRP 1998), the ISRP recommended that this study receive funding, citing its relevance to National Marine Fisheries Service and NWPPC programs. The importance of understanding and monitoring community level responses to adaptive management strategies has been further emphasized in a recent NWPPC planning document entitled "Development of a Regional Framework for Fish and Wildlife Restoration in the Columbia River Basin, A Proposed Scientific Foundation for the Restoration of Fish and Wildlife in the Columbia River Basin" (NWPPC 1998).

The proposed project would lay the groundwork for assessing the status of resident fish species and thus, native resident fish biodiversity and resident fish community structure in the Columbia River. Once an assessment plan has been rigorously developed (this proposal), resident fish species could be sampled, populations assessed, and trends identified. These data could be used in evaluations of both local (e.g., hydroelectric operations) and regional projects (e.g., watershed activities that influence mainstem river conditions).

c. Relationships to other projects

This is a proposed cooperative project between the U. S. Geological Survey, Oregon Department of Fish and Wildlife, and Washington Department of Fish and Wildlife. The proposed project's relation to other Fish and Wildlife program projects has been defined in the Mainstem Columbia River Umbrella proposal that describes the management intent for anadromous and resident fish in the mainstem Columbia and Snake rivers. The Mainstem Columbia River Umbrella proposal outlines several objectives. This proposed project was cited as one of several projects that would help achieve Objective 2: "Maintain and restore native resident fish, including white sturgeon, in the Columbia and Snake rivers." Further, the methodologies developed during the study would facilitate efficient data collection and spatial and temporal comparisons among future resident surveys. As stated previously, a primary objective of the proposed project is to develop standardized sampling gears, protocols, and methodologies, and to implement a statistically valid sampling design that can be used in future resident fish surveys.

The proposed project would also provide a means for assessing the impacts of other projects within the Fish and Wildlife program on the native resident fish populations in the lower Columbia River. Criteria established by the Columbia Basin Fish and Wildlife Authority's Resident Fish Caucus to assess proposed resident fish projects address these potential relationships. For example, technical criteria # 8 asks whether proposed projects "Demonstrate that all reasonable precautions have been taken, based on the best available science, to not adversely affect habitat/populations of native resident and anadromous fish." Similarly, other criteria ask whether projects significantly affect sustainable and/or ecosystem processes, desirable community diversity, or adversely affect weak but recoverable native fish stocks. Since the current status and habitat requirements of most native resident fish populations and the diversity of the fish community in the lower Columbia River are unknown, assessing the impacts of current and proposed projects on native resident fish in the lower Columbia River is impossible. This proposed project would provide information to help managers apply established project evaluation criteria to Fish and Wildlife program projects in the lower Columbia River.

d. Project history (for ongoing projects)

New Project.

e. Proposal objectives

1. Develop strict sampling protocols, standardized sampling gears, and a statistically valid sampling design to be used in resident fish surveys. Products: Report describing the protocols, results of our gear evaluations, specifications of gears used in the surveys, and a description of and rationale for the sampling design used.
2. Assess the status of resident fish populations in the Bonneville, The Dalles, and John Day reservoirs on the Columbia River. Products: Final report describing the relative abundance and community structure of resident fishes in the Bonneville, The Dalles, and John Day reservoirs; Peer-reviewed publications analyzing various aspects of the proposed project.

f. Methods

Objective 1. Task a. Assess the efficacy of various sampling gears to characterize resident fish populations.

Prior to selecting sampling gears to be evaluated, we will use pertinent literature and unpublished information from the USGS Columbia River Research Laboratory, Oregon Department of Fish and Wildlife, and Washington Department of Fish and Wildlife to obtain information on the efficiency and selectivity of various sampling gears commonly used in the basin. Also, information on gear efficiency and selectivity are available for many species that have been introduced into the Columbia River (Geutreuter et al. 1995, Hubert 1996). From these data we will decide which gears will be evaluated (e.g., bottom trawls, mid-water trawls, beach seines, gill nets, hoop nets, etc.).

To evaluate the selected gears we will conduct preliminary sampling in Bonneville Reservoir during 2000 using a stratified random sampling design (see Objective 1, Task c. below). Bonneville Reservoir was selected because of its proximity to our laboratory, which will reduce the cost of the evaluation. Preliminary sampling will be conducted during February-March and July-August so that the benefits and drawbacks of sampling during each, or both, of these periods can be assessed. During these periods, gears suitable for sampling various habitat strata will be fished and their relative selectivity (size and species) and relative efficiency will be compared (Yeh 1977, Jensen 1986, Beamesderfer and Rieman 1988, Holland and Peters 1992, Kraft and Johnson 1992, Reynolds 1996). For example, gears appropriate for sampling near-shore habitats will be fished in representative areas of this habitat type and relative selectivities and efficiencies of these gears will then be compared. This procedure will be conducted for both sampling periods and all habitat strata. Potential hypotheses to be tested include: H_o : There are no differences in the relative size and species selectivities and relative efficiencies among different sampling gears fished within specific habitat strata; H_o : There are no differences in the relative size and species selectivities and relative efficiencies among different sampling gears fished within specific habitat strata during February-March versus July-August. From this evaluation we can determine which sampling periods and combinations of gears will be the least selective and most efficient. Geutreuter et al. (1995) have found that combinations of gears are necessary to adequately characterize the community and population characteristics of fishes in the Mississippi River.

Objective 1. Task b. Develop sampling protocols for collecting and recording survey data.

Developing strict sampling and data recording protocols are necessary to ensure the success of these surveys. Detailed sampling protocols, data recording procedures, fish processing protocols, and quality assurance and quality control procedures will be developed prior to the surveys (Geutreuter et al. 1995, Geoghegan 1996).

Objective 1. Task c. Develop procedures for implementing a stratified random sampling design to be used in the surveys.

A stratified random sampling design for the surveys will be implemented by stratifying the

reservoirs using enduring geomorphic and physical features that represent important habitat types for fishes (Cochran 1977, Geutreuter 1995). Potential collection sites will be randomly selected using a geographic information system (GIS) of important habitats. Geographic Information System databases of river depths, substrates, and shoreline features are available at the USGS Columbia River Research Laboratory. Prior to the beginning of the surveys, lists of primary and alternate sample sites will be generated. Sites will be represented by 50 x 50 m grids in a GIS database that will also contain delineations of the known extent of the sampling strata. Within each reservoir, grids will be selected at random with uniform probability from each stratum to generate lists of primary collection sites for each gear. Sampling gears will be deployed independently within strata. For each primary site, the set of all grids of the stratum within a 1 km radius will be identified, and a second random selection of grids will be made, producing a list of alternate collection sites.

Objective 2. Task a. Implement sampling design and evaluate the sensitivity of sampling intensity to assess the status of resident fish populations.

Using the methodologies established from the completion of Objective 1, resident fish surveys will be conducted in the Bonneville, The Dalles, and John Day reservoirs. After the completion of the surveys conducted during 2001, the sensitivity of our sampling intensity in detecting among-strata and among-reservoir differences in relative abundances and length distributions of various species will be examined (Geutreuter 1992). We will incorporate the results of these analyses during 2002. There are limitations to the meaningful application of sample size estimation procedures in these types of surveys (Geutreuter 1995). Relative abundance and length distributions will be monitored for all species collected during the surveys. Consequently, many random variables will be generated for which sample size estimates could be calculated. A definitive estimation of adequate sample size will therefore involve subjective decisions about which variables are most important.

Objective 2. Task b. Analyze and summarize data in a final report and develop manuscripts for publication in peer-reviewed journals.

Estimates of the relative abundances of species collected during the proposed study will be calculated by strata and reservoir. Potential hypotheses to be tested include:
 H_o : There are no differences in the relative abundance of species among habitat strata;
 H_o : There are no differences in the relative abundance of species in habitat strata among reservoirs. To determine specifically what methodologies (parametric, nonparametric, etc.) will be used to test these hypotheses, initial estimates of variance and a knowledge of the distributional properties of the data will be necessary (Sokal and Rolf 1995). Population structures will be examined through an evaluation of the size distributions of various species. Potential hypotheses to be tested include: H_o : There are no differences in the size distributions of species among habitat strata; H_o : There are no differences in the size distribution of species in similar habitat strata among reservoirs. These hypotheses will be tested by evaluating chi-square tests (Sokal and Rolf 1995).

Fish community structure in each reservoir will be characterized and further examined by strata. Various multi-variate statistical techniques have been used to delineate quantitatively

distinctive associations of species (Gauch et al. 1986, Digby and Kempton 1994). Appropriate techniques will be identified and used to examine community structure. Using the classifications of Hughes and Gammon (1987), fish will be categorized by the trophic classification of the adults and their relative tolerance to organic pollution, warm water, and sediment. Relative abundances of fish in these categories will be reported by strata and reservoir.

g. Facilities and equipment

The USGS Columbia River Research Laboratory (CRRL) has been conducting research in the Columbia River Basin since 1978. Approximately 30 research vessels, including electrofishing boats and boats to 26 feet capable of bottom trawling, are routinely deployed throughout the basin to conduct research. The CRRL has state-of-the-art GIS capabilities and modern office equipment and facilities to support the research conducted by the staff.

h. Budget

Salaries include USGS, ODFW, and WDFW personnel that will participate in the study. The fringe benefits therefore represent a mix of the rates charged by these agencies. Specialized equipment purchased for this study primarily consists of fish sampling gears (bottom trawls, mid-water trawls, beach seines, gill nets, hoop nets, etc.) that are to be evaluated and used during the surveys. Operation and maintenance costs are primarily associated with boat operation during the study. Travel costs reflect vehicle rent and per diem associated with field work. A complete breakdown of the budget is available if needed.

Section 9. Key personnel

Co-principal investigators (USGS):

James H. Petersen. 0.2 FTE. Dr. Petersen will assist with the development of the procedures for implementing the stratified random sampling design, analysis of the gear evaluations, analysis of the sensitivity of sampling intensity, and all other statistical analysis of the data collected.

Timothy D. Counihan. 1.0 FTE. Mr. Counihan will coordinate all project activities and with the assistance of Dr. Petersen, be involved in all aspects of data collection and analysis.

Fish Biologist (WDFW):

John D. DeVore. 0.1 FTE. Mr. DeVore will provide technical assistance with planning, data collection, and data analysis.

Fish Biologist (ODFW):

David L. Ward. 0.1 FTE. Mr. Ward will provide technical assistance with planning, data collection, and data analysis.

Resume for: James H. Petersen
U.S. Geological Survey
Biological Resources Division
Columbia River Research Laboratory
5501-A Cook Underwood Road
Cook, Washington 98605

Experience

- 1995-Present Research Fishery Biologist, U.S. Geological Survey, Biological Resources Division, Columbia River Research Laboratory, Cook, WA.
Current responsibilities: Project leader on research project to determine survival of summer steelhead over their first winter in the Wind River Basin (WA). Co-leader on various mainstem Columbia and Snake River projects concerning juvenile salmon passage, predation, and reservoir drawdown.
- 1994 Acting Director, Columbia River Research Laboratory, USGS, Cook, WA.
- 1988-93 Research Fishery Biologist, Columbia River Research Laboratory, U.S. Fish and Wildlife Service.
- 1984-88 Associate Research Curator, Section of Fishes, Natural History Museum of Los Angeles County, Los Angeles, CA.
- 1983-84 Environmental Scientist, Section of Fishes, Natural History Museum of Los Angeles County.
- 1977-83 Graduate Teaching Assistant, University of Oregon, Eugene, OR.

Education:

- Ph. D., Marine Ecology, University of Oregon, 1983
Rotary Fellowship, University of Queensland, Australia, 1976
B. S., Biology, Boise State University, Idaho, 1975

Expertise: Primary areas of expertise include predator-prey dynamics, population dynamics, and application of various modeling techniques to fisheries.

Publications and Reports (five most relevant)

- Petersen, J. H., A. E. Jahn, R. J. Lavenberg, G. E. McGowen, and R. S. Grove. 1986. Physical-chemical characteristics and zooplankton biomass on the continental shelf off southern California. Calif. Coop. Oceanic Fish. Invest. Rep. 27:36-51.
- Petersen, J. H. 1994. The importance of spatial pattern in estimating predation on juvenile salmonids in the Columbia River. Trans. Am. Fish. Soc. 123:924-930.
- Petersen, J.H. and D.M. Gadomski. 1994. Light-mediated predation by northern squawfish on juvenile salmon. J. Fish Biol. 45: 227-242.
- Ward, D. L., J. H. Petersen, and J. J. Loch. 1995. Index of predation on juvenile salmonids by northern squawfish in the lower and middle Columbia River and in

the lower Snake River. *Trans. Am. Fish. Soc.* 124:321-334.
Petersen, J. H. and D. L. Ward. *In Press*. Development and corroboration of a bioenergetics model for northern squawfish feeding on juvenile salmonids in the Columbia River. *Trans. Am. Fish. Soc.*

Resume for: Timothy D. Counihan

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Biological Resources Division
Columbia River Research Laboratory
5501-A Cook Underwood Road
Cook, Washington 98605

Experience

- 1993-Present Research Fishery Biologist, U.S. Geological Survey, Biological Resources Division, Columbia River Research Laboratory, Cook, WA.
Current responsibilities: Team leader on research project examining the early life history of white sturgeons in the Columbia River Basin.
- 1991-92 Fisheries Technician, Idaho Department of Fish and Game, Coeur D'Alene, ID.
1989-91 Research Specialist, New Mexico State University, Las Cruces, NM.

Education:

M. S., Wildlife Science, New Mexico State University, 1991
B. S., Biology, Montana State University, 1989

Expertise: Primary areas of expertise include the design of fish and ichthyoplankton surveys, white sturgeon ecology, and larval fish ecology.

Publications and Reports (five most relevant)

- Counihan, T. D., A. I. Miller, and M. J. Parsley. *In Press*. Indexing the relative abundance of age-0 white sturgeon in an impoundment of the lower Columbia River from highly skewed trawling data. *North American Journal of Fisheries Management*.
- Counihan, T. D., and C. N. Frost. *In Press*. Influence of externally attached transmitters on the swimming performance of juvenile white sturgeon. *Transactions of the American Fisheries Society*.
- Counihan, T. D., A. I. Miller, M. G. Mesa, and M. J. Parsley. 1998. The effects of dissolved gas supersaturation on white sturgeon larvae. *Transactions of the American Fisheries Society* 127:316-322.
- Counihan, T. D., M. J. Parsley, D. Gallion, C. N. Frost, and M. N. Morgan. 1997. Report C in T. Rien, editor. Effects of mitigative measures on the productivity of white sturgeon populations downstream from McNary Dam and the status and habitat requirements of white sturgeon populations in the Columbia and Snake rivers upstream from McNary Dam.
- Miller, A. I., T. D. Counihan, M. J. Parsley, and L. G. Beckman. 1995. Columbia River Basin white sturgeon. Pages 145-157 in E. T. Laroe, editor. *Our living resources: a report to the nation on the distribution, abundance, and health of U.S. plants,*

animals, and ecosystems. U.S. Department of the Interior, National Biological Service. Washington, D.C.

Resume for: David L. Ward

Oregon Department of Fish and Wildlife
17330 S.E. Evelyn Street
Clackamas, OR 97015

Experience

- 1998-Present Program Leader for Northwest Region Research Program, Oregon Department of Fish and Wildlife, 17330 S.E. Evelyn St., Clackamas, OR.
Current responsibilities: Coordinate activities of ongoing departmental and interagency projects, identify needs for and develop future projects, provide technical oversight to project leaders, and supervise project leaders and other program staff. Coordinate and integrate activities of cooperating agencies, hire and supervise staff of project leaders, project biologists, and seasonal workers, design field and laboratory sampling plans, analyze wide variety of biological data, author, edit, and review scientific reports and peer-review articles. Organize personnel from cooperating agencies to give symposia at fisheries conferences. Develop and submit proposals for numerous research projects to various funding sources.
- 1991-98 Project Leader: Evaluation of the Northern Pikeminnow Management Program, Oregon Department of Fish and Wildlife.
- 1988-91 Project Leader: Portland Harbor Study, Oregon Department of Fish and Wildlife.
- 1984-87 Project Biologist and Technician on various studies, Oregon Department of Fish and Wildlife.

Education:

M. S., Fisheries, Humboldt State University, 1985
B. A., Zoology, Humboldt State University, 1978

Expertise: Primary areas of expertise include predator-prey dynamics, population dynamics of anadromous and resident fish, and the use of methods and gears associated with habitat and fish surveys in streams, rivers, lakes, and reservoirs.

Publications and Reports (five most relevant)

- Ward, D. L., and M. P. Zimmerman. *In Press*. Response of smallmouth bass to sustained removals of northern pikeminnow in the lower Columbia and Snake rivers. Transactions of the American Fisheries Society.
- Friesen, T. A., and D. L. Ward. *In Press*. Management of northern pikeminnow and implications for juvenile salmonid survival in the lower Columbia and Snake rivers. North American Journal of Fisheries Management.
- Zimmerman, M. P., and D. L. Ward. *In Press*. Index of predation on juvenile salmonids by northern pikeminnow in the lower Columbia river basin from 1994-96. Transactions of the American Fisheries Society.
- Beamesderfer, R. C., D. L. Ward, and A. A. Nigro. 1996. Evaluation of the biological basis for a predator control program on northern squawfish in the Columbia and

Snake rivers. Canadian Journal of Fisheries and Aquatic Sciences 53:2898-2908.
Ward, D. L., J. H. Petersen, and J. J. Loch. 1995. Index of predation on juvenile salmonids by northern squawfish in the lower and middle Columbia River and in the lower Snake River. Transactions of the American Fisheries Society 124:321-334.

Resume for: John D. DeVore

Washington Department of Fish and Wildlife
2108 Grand Boulevard
Vancouver, WA 98661

Experience

- 1989-Present Fish Biologist 4, Washington Department of Fish and Wildlife, Program Leader and species specialist in charge of the Washington Department of Fish and Wildlife's research and management program for native sturgeon species.
Current responsibilities: Plans, directs, and implements multiple programs that collectively assesses productivity of various white sturgeon populations residing within the state of Washington to understand population dynamics, factors limiting productivity, and utilization of critical habitats. Publishes research results in professional, peer-reviewed journals. Utilizes research results to design sustainable harvest strategies for various tribal, sport, and commercial fisheries in areas where productivity is sufficiently high and recovery strategies where productivity is critically low. Coordinates research and management activities with various international, federal, state, tribal, academic, and private entities.
- 1986-89 Fish Biologist 2, Washington Department of Fisheries, Implemented the collection and analyses of coded-wire tag and catch and effort data for run reconstruction and run size forecasting of salmon runs in the Columbia River and its Washington tributaries.
- 1983-85 Fish Biologist 2, Washington Department of Fisheries, Project Leader of the Cowlitz River Salmon Investigation Program.
- 1982-83 Scientific Technician 2, Washington Department of Fisheries.

Education:

B. S., Cornell University, 1980

Expertise: Primary areas of expertise include fish harvest management, the population dynamics of anadromous and resident fishes, and white sturgeon ecology.

Publications and Reports (five most relevant)

- DeVore, J. D., B. L. Parker, R. C. P. Beamesderfer, and T. A. Rien. *In press*. A review of alternatives for the restoration of white sturgeon populations and fisheries in the Columbia River between Bonneville and McNary dams (zone 6). Washington Department of Fisheries.
- DeVore, J. D., B. W. James, and D. R. Gilliland. 1998. Effects of mitigative measures on the productivity of white sturgeon populations downstream from McNary Dam

and the status and habitat requirements of white sturgeon populations upstream from McNary Dam. Bonneville Power Administration, Contract DE-A179-86BP63584.

DeVore, J. D., B. W. James, D. R. Gilliland, B. J. Cady, and M. F. Wail. 1997. Effects of mitigative measures on the productivity of white sturgeon populations downstream from McNary Dam and the status and habitat requirements of white sturgeon populations upstream from McNary Dam. Bonneville Power Administration, Contract DE-A179-86BP63584.

DeVore, J. D., B. W. James, C. A. Tracy, and D. H. Hale. 1995. Dynamics and potential production of white sturgeon in the unimpounded lower Columbia River. Transactions of the American Fisheries Society 124:845-856.

DeVore, J. D., and J. T. Grimes. 1993. Migration and distribution of white sturgeon in the Columbia River downstream from Bonneville Dam and in adjacent marine areas. *in* R. C. Beamesderfer and A. A. Nigro, editors. Status and habitat requirements of white sturgeon populations upstream from McNary Dam, volume 2. Bonneville Power Administration, Contract DE-A179-86BP63584.

Section 10. Information/technology transfer

Results of the study we propose will be summarized in annual progress reports, final reports, and in peer-reviewed journal articles and presented at technical meetings and conferences.

Congratulations!